



# Air Force Research Laboratory|AFRL

*Science and Technology for Tomorrow's Air and Space Force*

## **Success Story**

### **HIGH-PERFORMANCE SOLAR CELLS**



The high-efficiency solar cell Dual Use Science and Technology (DUS&T) program has developed single crystal solar cells with higher efficiencies and lower dollar-per-watt costs than any previous solar cells. These cells are baselined on all US military spacecraft now in the acquisition cycle.



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### **Accomplishment**

The Space Vehicles Directorate/Defense Advanced Research Projects Agency/Spectrolab/EMCORE team performed work from fiscal year (FY) 99-03 to develop the highest possible efficiency space solar cells. The EMCORE start-up company bid successfully on the DUS&T program and, within a year, provided a competitive product. This reestablished the historical dual sources of domestic solar cells, with the associated risk and cost reduction benefits.

By mid-FY02, both Spectrolab and EMCORE were offering 27.5% production cells and 29-30% best cell efficiencies. In addition to these performance improvements, better production processes resulted in a 20% reduction in dollars/watt cost of the cells.

These solar cell products are by far the best in the world, completely dominating the domestic military, civilian, and commercial markets, as well as being selected for many foreign spacecraft. Their rapid insertion into current US military satellite programs attests to their mission-enabling qualities.

For example, the Advanced Extremely High Frequency and Wideband Gapfiller systems, the follow-on programs to the Military Strategic and Tactical Relay Satellite, along with certain classified programs, are spacecraft that were required to transition to the Evolved Expendable Launch Vehicle class of launchers from the Titan IV used by their predecessors. The high-performance solar cells developed by this DUS&T program enabled that transition without a loss in available power that would have otherwise resulted from the necessary decrease in solar array area.

### **Background**

When this program began, the state of the art in multijunction solar cells was 24% efficiency in production lots and approximately 25.5% best cell efficiency. A Manufacturing Technology program funded Spectrolab and TECSTAR to develop these first triple-junction solar cells. The directorate worked jointly with Sandia National Laboratory to identify further improvements for adjustment of the sub-cell bandgaps. The directorate initiated the DUS&T program with the goal of achieving 35% efficiency cells through development of new materials with more optimal bandgaps and compositional tailoring of the existing materials.

### **Additional information**

To receive more information about this or other activities in the Air Force Research Laboratory, contact TECH CONNECT, AFRL/XPTC, (800) 203-6451 and you will be directed to the appropriate laboratory expert. (03-VS-07)

Space Vehicles  
Emerging Technologies